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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/026,935	12/18/2001	Alan Sullivan	30231/40	7292

7590 .08/24/2005

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EXAMINER

TRAN, TAM D

ART UNIT	PAPER NUMBER
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2676

DATE MAILED: 08/24/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/026,935

Applicant(s).

SULLIVAN ET AL.

Examiner

Tam D. Tran

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 03 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 7/26/2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1,2,4-9,12,13,16-23,47,48,50-55,58,59 and 62-101 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☒ Claim(s) 92-101 is/are allowed.
- 6) ☒ Claim(s) 1,2,4,5,7,9,12,13,16-23,47,48,50,51,53,55,58,59,62-69 and 76-91 is/are rejected.
- 7) ☒ Claim(s) 6,8,52,54 and 70-75 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☒ Interview Summary (PTO-413)  
Paper No(s)/Mail Date 05/07/2005.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 2, 4, 5, 7, 9, 12, 13, 16-23, 47, 48, 50, 51, 53, 55, 58, 59, 62-69 and 76-91, are rejected under 35 U. S.C. 103(a) as being unpatentable over Kaufman et al. (USPN 5760781) in view of MacFarLane (USPN 5801666), hereinafter simply Kaufman and MacFarLane.

2. In regard to claims 1, 47, Kaufman teaches a system and method of processing three-dimensional image data for a three-dimensional volumetric display having a plurality of display surfaces (pixels, voxels), the method comprising: generating three-dimensional image data, comprising (x,y,z) coordinate and color information, wherein the z-coordinate information represents image depth information; see col.2 lines 60-68, col.4 lines 10-40, and storing the three dimensional image data at locations in a multiplanar (cubic frame buffer) frame buffer in accordance with the z-coordinate information, wherein each of said locations in said multiplanar frame buffer is associated with a corresponding pixel on one of said plurality of display surfaces (voxels are stored in cubic memory, voxel beam is preferably substantially parallel to cubic memory, then plurality of viewing rays are generated one for each pixel of the display screen). See col.6

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lines 20-48, col.4 lines 1-20. Kaufman does not teach plurality of display surfaces.

However, MacFarLane teaches plurality of display surfaces. Fig.2, col.4 lines 37-55. It would have been obvious to a person of ordinary skill in the art at the time of the invention to incorporate three dimensional display of MacFarLane into the cubic frame buffer of Kaufman because a combination of three dimensional display and cubic frame buffer would provide an external focused source of electromagnetic radiation, which can be focus upon individual voxels.

3. In regard to claims 2, 48, Kaufman teaches a system and method of displaying a three-dimensional image wherein the storing comprises: reading the z-coordinate information; scaling the z-coordinate information within a range corresponding to one or more display elements in the three-dimensional volumetric display upon which the three-dimensional image is to be displayed; and assigning memory locations in the multiplanar frame buffer for the three-dimensional image data based on the scaled z-coordinate information (distance between rays increase which read on scaling the z-coordinate information within a range). See col.8 lines 55-60.

4. In regard to claims 4, 50, Kaufman teaches a system and method of displaying a three-dimensional image wherein the storing comprises storing image data having substantially identical z-coordinate information in memory locations of the frame buffer that are logically substantially proximate. See col.6 lines 20-25.

5. In regard to claims 5, 51, Kaufman teaches a system and method of displaying a three-dimensional image further comprising displaying an image on a display having addressable (x,y,z) coordinates. See col.6 lines 38-42.

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6. In regard to claims 7, 53, Kaufman teaches a system and method of displaying a three-dimensional image further comprising displaying an image on a display having addressable (r, Y, and theta) coordinates (x,y,z.coordinates). See col.6 lines 38-42.
7. In regard to claims 9, 55, Kaufman teaches a system and method of displaying a three-dimensional image wherein storing comprises: providing a first memory at least as large as the frame buffer; filling the first memory with the three dimensional image data; and transmitting the contents of the first memory location to the frame buffer in a single operation. See col.6 lines 20-25.
8. In regard to claims 12, 58, Kaufman teaches a system and method of displaying a three-dimensional image further comprising transmitting the three-dimensional image data to a display in accordance with the z-coordinate information. See col.6 lines 38-42.
9. In regard to claims 13, 59, Kaufman teaches a system and method of displaying a three-dimensional image wherein the image data further comprises transparency information (translucency) and brightness information. See col.4 lines 32-40.
10. In regard to claims 16, 62, Kaufman teaches a system and method of displaying a three-dimensional image further comprising displaying an image on a three dimensional volumetric display. See Fig.3.
11. In regard to claims 17, 63, Kaufman teaches a system and method of displaying a three-dimensional image wherein the three dimensional volumetric display comprises multiple planes upon which image data is displayed. See col.15 lines 45-65
12. In regard to claims 18, 64, Kaufman teaches a system and method of displaying a three-dimensional image wherein the three dimensional volumetric display comprises a

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plurality of self-luminescent optical elements (every pixel on the screen having optical element associated with it). See col.2 lines 60-65.

13. In regard to claims 19, 65, Kaufman teaches a system and method of displaying a three-dimensional image wherein the three dimensional volumetric display is a swept-volume display (volume projection image). See col.2 lines 60-67.

14. In regard to claims 20, 66, Kaufman teaches a system and method of displaying a three-dimensional image wherein generating comprises generating the three-dimensional image data with a personal computer. See col.1 lines 35-37.

15. In regard to claims 21, 67, Kaufman teaches a system and method of displaying a three-dimensional image wherein generating comprises converting data corresponding to a three-dimensional image into data corresponding to a plurality of two-dimensional cross-sectional images (slices of voxels data that are parallel) of the three-dimensional image. See col.2 lines 60-67.

16. In regard to claims 22, 68, Kaufman teaches a system and method of displaying a three-dimensional image wherein the generating comprises generating the three-dimensional image data using application program interface calls (using computer graphic system which has graphic programs). See col.1 lines 30-34.

17. In regard to claims 23, 69, Kaufman teaches a system and method of displaying a three-dimensional image wherein generating comprises generating data indicating a plurality of geometric primitives (lines and points) that define three-dimensional image. See col.13 lines 15-25.

18. In regard to claims 76-79, Kaufman teaches a system and method of displaying a three-dimensional image, wherein the storing comprises storing the three-dimensional

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image data having substantially identical z-coordinate information in memory locations within one common physical partition of the multiplanar frame buffer (cubic frame buffer). See col.6 lines 20-45.

19. In regard to claims 80, 81, Kaufman teaches a system and method of displaying a three-dimensional image, wherein the multiplanar frame buffer (cubic frame buffer) is located in the three-dimensional volumetric display. See col.6 lines 20-45.

20. In regard to claims 82, 83, Kaufman teaches a system and method of displaying a three-dimensional image, wherein the first memory comprises a multiplanar frame buffer (cubic frame buffer). See col.6 lines 20-45.

21. In regard to claims 84, 88, Kaufman teaches a system and method of displaying a three-dimensional image, wherein the storing comprises: processing the three dimensional image data; assigning memory locations in the multiplanar frame buffer (cubic frame buffer) for the three dimensional image data in accordance with the (x,y,z) coordinate information; and transferring the processed three dimensional image data to the assigned memory locations in the multiplanar frame buffer (cubic frame buffer). See col.6 lines 20-49.

22. In regard to claims 85, 89, Kaufman teaches a system and method of displaying a three-dimensional image, wherein the processing comprises performing depth testing. See col.6 lines 38-45.

23. In regard to claim 86, 90, Kaufman teaches a system and method of displaying a three-dimensional image, wherein the processing comprises performing multiplanar antialiasing. See col.8 lines 43-55.

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24. In regard to claim 87, 91, Kaufman teaches a system and method of displaying a three-dimensional image, wherein the processing comprises performing alpha blending. See col.10 lines 15-20.

*Allowable Subject Matter*

25. Claims 6, 8, 52, 54, 70-75, are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

26. Claims 92-101, are allowed.

27. The following is a statement of reasons for the indication of allowable subject matter: The closest prior art shows an apparatus for generating a three-dimensional volume projection image of an object, the apparatus having cubic frame buffer but does not disclose a method of assigning a location in the frame buffer for the three dimensional image data in accordance with the equation:

$$\text{Addr} = N.\text{sub.b/p} * (x + N.\text{sub.x} * y + N.\text{sub.x} * N.\text{sub.Y} - * z.\text{sub.i})$$
 wherein Addr is the assigned memory location in the multiplanar frame buffer for image data having coordinates (x, y, z), N.sub.b/p is the number of bytes of information stored for each pixel, N.sub.x is the number of pixels in the x direction of a display, N.sub.Y is the number of pixels in the y dimension of a display, and Z.sub.i is an integer portion of the scaled z-coordinate value.

The closest prior art shows an apparatus for generating a three-dimensional volume projection image of an object, the apparatus having cubic frame buffer but does not disclose a method of assigning a location in the frame buffer for the three dimensional image data in accordance with the equation: 
$$\text{Addr} = N.\text{sub.B/P} * (r * \cos(\theta) +$$



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$N_{\text{sub}.r} \cdot y' + N_{\text{sub}.r} \cdot N_{\text{sub}.y'} \cdot r \cdot \sin(\theta)$  wherein Addr is the assigned memory location in the multiplanar frame buffer for image data having coordinates (r, y' and theta), N.sub.B/P is the number of bytes of information stored for each pixel, N.sub.r is the number of pixels in the r direction of a display, N.sub.y' is the number of pixels in the y dimension of the three-dimensional volumetric display.

The closest prior art shows an apparatus for generating a three-dimensional volume projection image of an object, the apparatus having cubic frame buffer but does not disclose a step of discarding the three dimensional image data associated with a second pixel if the transparency information associated with a first pixel indicates that the first pixel is opaque, when the first pixel and the second pixel have the same (x,y) coordinate values, and the z-coordinate value associated with the second pixel indicates that the second pixel is behind the first pixel.

The closest prior art shows an apparatus for generating a three-dimensional volume projection image of an object, the apparatus having cubic frame buffer but does not disclose a step of modulating the color information / brightness information associated with a second pixel based on the transparency information associated with a first pixel, when the first pixel and the second pixel have the same (x,y) coordinate values, and the z-coordinate value associated with the second pixel indicates that the second pixel is behind the first pixel.

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***Conclusion***

28. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Tam D. Tran** whose telephone number is **571-272-7793**.

The examiner can normally be reached on MON-FRI from 8:30 – 5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, **Matthew Bella** can be reached on **571-272-7778**. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Tam Tran

*TT*  
Examiner

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**MATTHEW C. BELLA**  
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